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ABSTRACT

This paper describes "The Internet: Communicating, Accessing & Providing Information," a University of Alberta (Canada) credit course which is delivered over the Internet. The purpose of this course is to help students understand what the Internet is and to learn to use Internet tools. The paper: (1) discusses the primary development and delivery phases of this course, while also providing a general account of the time spent on each of the phases; (2) compares the costs of this course with those of similar face-to-face courses; and (3) offers an interpretation of these results and the possible implications for similar courses. Five tables present data on times for course development and pilot testing; total hours spent on operation and delivery of the course, number of interactions between students and instructors/teaching assistants, time spent in each area of the course by instructors/teaching assistants, and a summary of time spent on the course by instructors/teaching assistants. Two graphs present data on time spent on the course by the instructor and the teaching assistant and a comparison of times for delivering World Wide Web-based instruction and face-to-face instruction. (Author/AEF)

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Costs of Developing and Delivering a Web-based Instruction Course

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Abstract: *The Internet: Communicating, Accessing & Providing Information* is a University of Alberta credit course which is delivered completely over the Internet. This paper: 1) discusses the primary development and delivery phases of this course, while also providing a general account of the time spent on each of the phases, 2) compares the costs of this course with those of similar face-to-face courses, and 3) offers an interpretation of these results and the possible implications for similar courses.

History of the Course

The Internet: Communicating, Accessing & Providing Information (<http://www.quasar.ualberta.ca/nethowto>) (henceforth referred to as "the course") has been offered since 1995. The purpose of this course is to help students understand what the Internet is (and isn't), and learn to use Internet tools. This course prepares students to operate effectively in our knowledge-based society, to learn to use electronic communications, to access electronic resources, to prepare electronic resources for the Internet, and to understand and examine critical issues related to electronic communications (Privacy, Security, Copyright, Censorship, and others). The course was delivered for the first time in a face-to-face (F2F) mode September-December 1995. A number of Web pages were developed to support this delivery. The course was offered a second time January - April 1996, again in a F2F mode. During this session, students were asked to provide information on what would make the course more amenable for use by distanced students; this input resulted in a constant revision of the Web pages.

During the second offering of the course, a few students who, for a number of reasons, could not attend the lectures were encouraged to take the course and to rely on the Web pages for their information. They were asked to communicate with the instructors by telephone or electronic mail if they had questions. During May-August, 1996 the course was pilot tested completely over the Internet to over 100 students. Over 500 students have completed the course since it has been offered through Web-based Instruction. A complete discussion of the structure of the course can be found in [Montgomerie & Harapnuik 1997].

Development

The course was developed over a period of slightly more than one year. Four different phases of development occurred, with three different people involved in this development: a graduate student and the first two authors. [Tab. 1] presents the time spent (costs¹) in developing this course. Times for the F2F delivery are not included in [Tab. 1] but times for delivering the pilot test of the course during the May - August 1996 period are included. The first time this course was offered via web-based instruction (WBI) (and probably the first time any WBI course is offered) can more properly be considered as development time rather than operation and delivery time because real students encounter problems and request clarification that the course authors did not anticipate.

¹ Throughout this paper we present the time spent on a task and call these "costs." Conversion of these times to dollars (or yen) using arbitrary values would obfuscate, rather than clarify the issues.

Task	Hours
Development of course outline and identification of course resources (May – July, 1995)	200
Original Web page design and major revision of course resources (August – December, 1995)	400
Course revision during F2F delivery (January - April, 1996)	60
Course revision prior to first asynchronous delivery (April – May, 1996)	30
Course revision and delivery during first asynchronous delivery (June – September, 1996)	750
Total	1440

Table 1: Times for Course Development and Pilot Testing

Following the initial delivery, the course has undergone major updates prior to each session. Because this course is about the Internet the subject matter is constantly changing; thus the course materials need to be updated on an ongoing basis, even during course delivery. Similarly, we needed to use the latest features on the Internet to model appropriate use of the best technology and instructional methods (i.e. "walk the talk"). Taken together, these two situations mean that this course has required a higher level of upgrading than most other WBI courses. The dynamic nature of the Internet demands that content, links, and entire technologies must be continually upgraded. Ironically, perpetual change has been one of the unchanged aspects of this course and we do not expect to see a decline in the rate of change for some time to come.

Course Operation and Delivery

The course has now been offered via asynchronous delivery mode for seven complete sessions. [Tab. 2] shows the time spent on operation and delivery of the course once it had reached "steady state," that is once major development and pilot testing was complete. As indicated previously, the times for the pilot test (May - August 1996) are included in [Tab. 1] rather than [Tab. 2].

The instructor and the teaching assistant (TA) recorded the time spent on six specific course operation and delivery responsibilities in a daily journal. The course operation and delivery responsibilities included updates (revising links, adding news & announcements, etc.), development (adding material or incorporating changes in technology), interacting with students in the Issues & Help conferences, providing email and phone support, and marking. [Tab. 2] summarizes these results for six steady-state offerings from September 1996 to April 1998.

Session	Fall 96	Win 97	Spr 97	Sum 97	Fall 97	Win 98
# of Students	40	78	49	53	71	89
Tasks	Hours	Hours	Hours	Hours	Hours	Hours
Updates (URLs, News Page, etc.)	28	48	5	23	37	41
Development (New material)	13	26	4	37	21	17
"Issues & Help" conferences	240	181	76	50	58	95
Phone support	15	25	13	36	25	16
E-mail Support	27	141	104	101	159	113
Marking	63	127	123	74	173	155
Total Hours	386	548	325	321	473	437
% of total time spent on upgrading and development	10.6	13.5	2.8	18.7	12.2	13.3
% of time spent on interaction	73.1	63.3	59.4	58.3	51.1	51.3
% of time spent on marking	16.2	23.2	37.8	23.1	36.6	35.4

Table 2: Total Hours Spent on Operation and Delivery of the Course

An average of 415 hours was spent delivering and supporting this course each session. During the Fall and Winter Sessions the course is delivered over a 13-week semester while during the Spring and Summer Sessions the delivery time is approximately 6 weeks.

The time devoted to the Issues & Help conferences decreased after Winter 1997 as a result of the implementation of a more efficient conferencing system and a course management system [Montgomerie, Harapnuik & Palmer 1997]. These two improvements have streamlined the management aspects of the course. A great deal of development time was spent creating and implementing these systems, but because they were not directly related to the instruction of the course, they do not appear in these tables.

Marking times increased significantly in the Fall and Winter sessions. This may be attributed to the fact that Fall session students were granted extensions until April 1 to complete their work. Similarly, Spring session students were granted extensions to September 1, and Summer Session students were given extensions to December 31. The cumulative effect of these extensions is that more students were handing in assignments than the enrollment for the Fall and Winter sessions would indicate.

Development & Upgrading

The ever-changing nature of the Internet requires that constant updates and upgrades must be made to URLs, course content, and assignments. Change has been the one constant throughout the development and delivery of this course. The updates/upgrades and development tasks are closely related. Most course development and upgrades are a result of technology advancement. One of the most tedious tasks is keeping hundreds of URLs current. The time consuming aspect to keeping the links updated is not in finding the broken links, software is available to do this, but a substantial amount of time can be spent finding the new URL for the moved site, or finding (or developing) a replacement for a site that has completely vanished or has become outdated.

Since there is no F2F instruction in this course, students are kept apprised of new information and announcements via an "Announcement" page. Another update is the addition of projects prepared by students enrolled in previous course sections to the course resources database. Other upgrades or course modifications are the result of student suggestions received through email, phone, or the conferencing system. Our policy is that when a student submits an email message directly to the instructor asking for clarification on a particular section of the course, that section is immediately examined and, if necessary, changes or clarifications are made immediately. When a student posts a question to the Help conference, we wait for 24 hours to respond or to make changes or clarifications to the course. Twenty percent of a student's mark is allocated to his/her participation in the Help and Issues conferences; hence it would be inappropriate for the instructor or teaching assistant to respond immediately. Implementing rapid change can be time consuming, but it dramatically improves the content and structure of the course. In addition, students gain a sense of significance or community by seeing that their feedback has immediate results.

In addition to upgrades, time is spent integrating new technology into the course. New technologies like CU-SeeMe™, CoolTalk™, NetMeeting™, HTML editing tools, new browsers, and anything else that is new on the Internet must be tested to see if it can and should be included in the course. For example the Fall 1996 and Winter 1997 sessions saw the integration of CU-SeeMe™².

More time was spent in upgrading and development during Winter and Summer sessions [Tab. 2]. The increase in time spent on development and upgrading in the Winter session is in preparation for the upcoming Spring and Summer session. Similarly the increased time spent on upgrading and development in the Summer session is in preparation for the upcoming Fall and Winter sessions.

Support and Interaction

Direct student support includes instructor and teaching assistant time spent working on the Issues & Help conferences and phone and email support. These three components of a web-based course are crucial to the course's successful delivery and to the students' learning experience. In addition, each plays a major role in offering students who do not have the opportunity to meet F2F an opportunity to interact with the instructor. A variety of support opportunities must be presented because different students have different learning styles that

² CU-SeeMe is a trademark of White Pine Software, CoolTalk is a trademark of InSoft Inc., and NetMeeting is a trademark of Microsoft.

often require a different level of interaction. Some students insist on using the telephone to make a more personal contact. Other students are satisfied with the conferencing system and others seek a middle ground by using email.

The instructors and teaching assistants spent more than half the course delivery time in some form of interaction. [Tab. 2] shows a significant decrease in time spent responding to questions on the Issues & Help conferences after the Winter 1997 session. This difference was the result of the implementation of a much superior conferencing system for Spring 1997. With the conferencing component playing such a substantial role in replacing F2F interaction it is imperative that the most effective, efficient and economical conferencing system be employed.

It can be argued that the current levels of interaction are higher than in a traditional F2F setting. Participation in the Help and Issues conferences is required of all students and makes up 20% of the final course mark. Because of this, total class interaction is very high, and virtually all students participate. Some students keep their interactions to a minimum and others go well beyond the required interaction levels on the conferences. Many students acknowledge that the conference system offers a level playing field and makes interaction much more comfortable. A major portion of the time spent on the course for both students and the instructors is spent in some form or interactive communication.

Different sessions have had different levels of interaction. For example, Spring session of 1997 saw an average of 47.9 interactions per student [Tab. 3]. More than 50% of those interactions were in the form of email communication directly with the course instructor or TA. On average there have been over 38 interactions per student. It must be stressed that more than 50% of these interactions were between the student and instructor. This is a high level of interaction for any type of course.

Session	Fall 96	Win 97	Spr 97	Sum 97	Fall 97	Win 98
# of Students	40	78	49	53	71	89
"Issues & Help" conferences	n/a	n/a	1077	1064	1277	2892
E-mail Support	319	1299	1173	926	1035	1256
Total	319	1299	2250	1990	2312	4148
Average interactions per student	*IN	*IN	45.9	37.5	32.6	46.6
*IN: Incomplete statistic. We were not able to extract an accurate message count from the conferencing system used in Fall 1996 and Winter 1997.						

Table 3: Number of Interactions between Students and Instructors/Teaching Assistants

Marking

Evaluating student work is always an important part of any course. Depending on the content and assignments, marking can either be very time consuming or it can involve very little time and even be automated. The androgogical foundation to this course is that people learn by doing. All assignments deal with actual skills needed to function on the Internet. The course has no exams and except for two small assignments the student evaluation is project based. Students are required to build an HTML portfolio, worth 25% of their final grade, which demonstrates their Internet skills. They are also required to do a final project, the development of a Web site on the topic of their choice, which is worth 50% of their final mark. Grading these projects can be very time consuming, however. To assure objective marking, a template has been developed, which gives students detailed feedback on the two major projects in the course. A major portion of the marking time deals with the writing of these detailed evaluations.

The proportionally higher marking times in the Winter and Fall sessions [Tab. 2] can be attributed to the higher number of students working on extensions in these two sessions than the number of students working on extensions in the Spring and Summer sessions.

A Cost Comparison with F2F Courses

[Tab. 4] shows the number of hours the Instructors and TAs spent in each area of the course for the six “steady state” sessions and [Tab. 5] summarizes that data. An examination of [Tab. 4] shows that the time spent monitoring the electronic conferences was inordinately high for the first two sessions. Replacement of the conferencing system following the Winter 1997 session reduced this time by approximately half. Corrected times, which reduce this time by half for the first two sessions are included in [Tab. 5].

		E-mail		Conference		Telephone		Marking		Develop- ment	Updating
	# of students	Instructor	TA	Instructor	TA	Instructor	TA	Instructor	TA	Instructor	Instructor
Fall 96	40	27		240		15		63		13	28
Win 97	78	65	33	182	7	0	1	46	101	26	48
Spr 97	49	46	59	78	27	2	11	32	91	4	5
Sum 97	53	50	50	50	10	20	16	26	49	37	23
Fall 97	71	81	78	58	4	13	11	26	148	21	37
Win 98	89	45	68	94	0	15	2	17	138	17	41

Table 4: Time (in hours) Spent on Course by Instructors/Teaching Assistants

Session	Number of students	Instructor Hours	TA Hours	Instructor Hours (corrected)	TA Hours (corrected)
Fall 96	40	386		266.0	
Winter 97	78	367	142	276.0	91.5
Spring 97	49	167	188	167.0	188.0
Summer 97	53	206	125	206.0	125.0
Fall 97	71	236	241	236.0	241.0
Winter 97	89	229	208	229.0	208.0
Linear Regression	Intercept	281.4	117.1	192.7	137.2
	Slope	-0.257	0.937	0.6	0.5

Table 5: Summary of Time Spent on Course by Instructors/Teaching Assistants

[Fig. 1] displays a graph of the number of hours that the Instructors and the Teaching Assistants worked on the course by the number of students enrolled in each session. The corrected times (reducing the time spent monitoring the conferences for the first two sessions by half) are also plotted. A linear regression has been plotted for each series. The intercept and slope for each regression line are given in [Tab. 5]. As can be seen, the intercept for the corrected values for the instructor is 192.7 (that is, if there were no students enrolled in the course, the instructor would spend approximately 193 hours on the course). The slope of the line for the corrected values for the instructor is 0.221 (that is, each student adds a load of approximately 0.22 hours to the instructor). The intercept for the corrected values for the TA teaching assistant is 120.9 (that is, if there were no students enrolled in the course, the teaching assistant would spend approximately 121 hours on the course). The slope of the line for the corrected values for the teaching assistant is 0.106 (that is, each student adds a load of approximately 0.10 hours to the teaching assistant).

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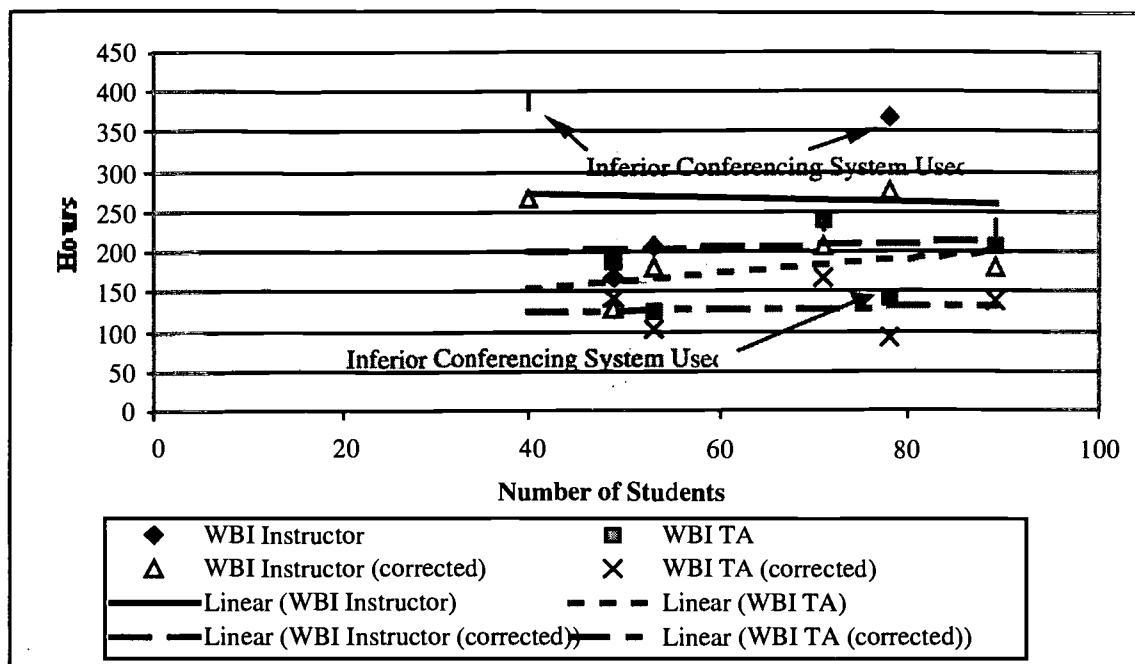


Figure 1: Time Spent on the Course by the Instructor and the Teaching Assistant

At the University of Alberta, where we teach, each course is allocated approximately 35 hours of lecture time. If we assume that for each hour in the classroom a professor spends another hour in preparation or marking (likely a low estimate); an average course would require approximately 70 hours of instructor time. Normally graduate courses are limited to 20 students (this was originally designed as a graduate course but due to a strong demand, senior undergraduate and unclassified students have been allowed to enroll in the course). Furthermore this is a laboratory course which would require teaching assistant to monitor a 3-hour lab of about 25 students (the size of our computer labs) each week for 12 weeks (a total of 36 hours).

[Fig. 2] overlays estimated time allotments for F2F Instructors and F2F teaching assistants on the WBI (corrected) regression lines from [Fig. 1]. Note that resources expended on students enrolled in WBI courses can be considered to be incremental, while expenditures on students enrolled in F2F courses should be considered to be a step function due to limitations such as the number of seats available in classrooms and laboratories. We have used a step function of 20 students for the instructor and 25 for the teaching assistant. An examination of [Fig. 2] shows that the WBI instructor spends more time per student up to 40 students at which point the amount of time spent by the F2F instructor becomes greater. Similarly, the WBI TA spends more time per student up to 75 students where the amount of time spent by the F2F TA becomes greater.

Some may dispute the choice of a class size of 20 students. In our course there is a high degree of interaction between the instructor and the students; this would be more similar to a seminar than to a lecture. If someone wished to deliver a WBI course with substantially fewer interactions, it might be comparable to F2F instruction in a 100-seat lecture theatre. If that were the case, then the time spent by the WBI instructor monitoring electronic conferences should be reduced close to zero. In the case of our course, the average number of students enrolled in each session has been 63.3 which means a time savings was incurred by offering the course by WBI rather than in a F2F mode.

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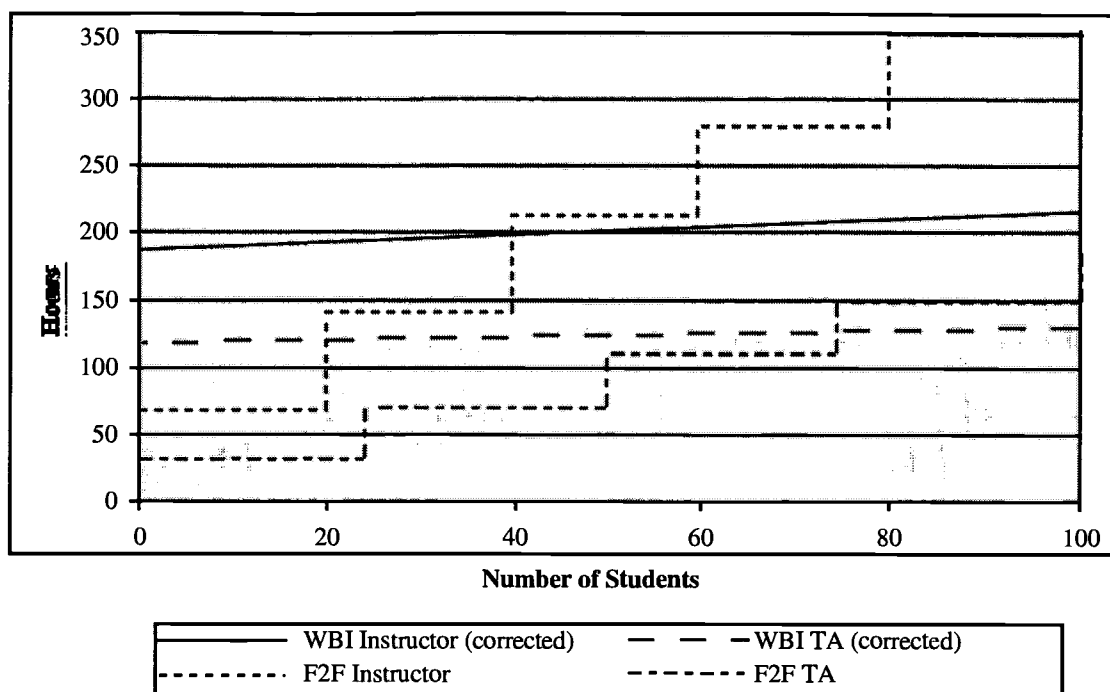


Figure 2: Comparison of Times Delivering WBI with F2F Instruction

When considering these costs, one must remember that the nature of both the content and delivery of this course is likely changing more rapidly than in most other courses. However, the costs for courses taught by WBI which deal with less rapidly changing subject matter are still likely to be higher than for an equivalent F2F course when there are low enrollments. When considering costs, however, one must also consider the level of success that has been achieved. Over 50% of the time spent on the delivery of this course has been spent on some aspect of interaction (email, conferencing, and phone). This high level of interaction is a major contributor to the 90% completion rate that we have experienced since the course has been delivered.

The times discussed so far in this section are for the ongoing delivery of instruction. None of the development time identified in [Tab. 1] has been included. The time spent preparing a new course is substantial for both WBI and F2F instruction, but before the course begins, WBI instructors need to prepare all materials in a form that the student can access on-line. In the case of our course, this preparation was 1440 hours, which is likely substantially more than is required for the development of a new F2F course. This development time should be prorated over some of the "steady state" delivery sessions. Further, Instructors and administrators must recognize the time involved in developing a WBI course and budget time for this development.

Conclusions & Recommendations

When implemented properly, WBI can offer a quality instruction with a much higher degree of interactivity for relatively large classes than may be possible in traditional F2F settings. It is clear from this study that, at least in this specific case, this course took less person hours to deliver than it would have if it were offered in a F2F mode. Of course, if the course had not been offered via WBI, we would have had a much smaller enrollment because the students in Singapore, Freiburg, Pender Island and Teepee Creek would not have been able to take the course.

Students took advantage of e-mail and conferencing systems to communicate directly with the instructors. Some would suggest that we could ask TAs to assume a considerable portion of this workload, but we would argue that it is important that students have this access to the instructor. Further, the offering of this course through WBI rather than F2F meant that University facilities like classrooms, washrooms and those very expensive computer laboratories were not used by these students.

On the other hand, WBI has substantial costs. The development of a new WBI course requires the allocation of substantial time. The high degree of instructor/student interaction in this course puts substantial strain on the instructor; there are no office hours, but the instructor must read and respond to e-mail, phone and conference messages at least once a day. Further, courses with a low enrollment will cost more to deliver via WBI than would an equivalent F2F course.

University administrations need to look seriously at the economics of implementing WBI. If instructors are given the time that is actually required to work using this form of delivering education, then it can be a very educationally effective and cost-effective method of instruction. However, if instructors are expected to develop, maintain, and support this type instruction with the same time expectations of F2F delivery, the quality of education will be in jeopardy and instructors will run the risk of burnout.

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